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ABSTRACT

The value of pictures as prose-learning adjuncts is the topic of the study described in this report. The experiments involved in the study followed five basic guidelines: oral presentation was chosen in order to measure comprehension while eliminating word-decoding problems; elementary school children were the subjects; fictional narratives that were unknown to the subjects were selected in an attempt to separate what was learned from what was already known; the pictures involved overlapped the story content; and learning was demonstrated by factual recall, to distinguish between assessment of a passage's factual information and assessment of its theme, mood, and logical inferences. Based on the evidence presented, picture presentation does facilitate the prose learning of children. Picture effects also generalize across a number of situational variables including methods of presentation, learner characteristics, passage characteristics, levels of recall, and time. (MAI)

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Theoretical Paper No. 69

ON PICTURES IN PROSE

by

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Report from the Project on
Studies in Reading, Language, and Communication

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In this paper, we review studies of prose learning in which the role of pictures has been examined. Despite previous claims to the contrary (e.g., Concannon, 1975; and Samuels, 1970), we conclude that there is solid evidence that pictures facilitate prose learning. Two points will be made at the outset. First, although a number of recent prose-learning studies have dealt with "pictures" in the form of learner-generated visual images, these will not be explicitly considered here. Since our focus here is on experimenter-provided pictures, imagery-in-prose studies might better be left for another day (for a preliminary report, see Levin, 1976; and 1977). Second, before we begin we are obliged to lay down a number of boundary conditions or "groundrules" associated with the research we intend to review. These groundrules will not unnecessarily restrict the pictures-in-prose phenomenon under consideration here (see, for example, DeRose, 1976; Gibbons & Boutwell, 1972; Goldberg, 1974; Hempstead, 1973; Jahoda, Cheyne, Deregowski, Sinha, & Collingbourne, 1976; Peeck, 1974; Rasco, Tennyson, & Boutwell, 1975; Rigney & Lutz, 1976; and Snowman & Cunningham, 1975). Rather, the groundrules provide a basis for understanding why not all pictures-in-prose manipulations would be expected to produce positive results.

THE GROUNDRULES

The experiments to be reviewed generally share five important commonalities:

1. The prose passages are presented orally;
2. The subjects are children;
3. The passages are fictional narratives;
4. The pictures overlap the story content; and
5. Learning is demonstrated by factual recall.

We now elaborate on, and provide justification for, each of these ingredients.

Oral Presentation

Reading researchers typically concern themselves with one of two major reading components, loosely defined as decoding and comprehension. These components may well interact in ways that limit their separability (cf. Perfetti & Lesgold, in press), but they do represent separate teaching goals. Since the focus of the present paper is on comprehension and not decoding, it is important that the performance measures selected do not confound the two (see Golinkoff, 1975-76). For example, it is intuitively obvious that decoding inability (or lack of facility) precludes reading with comprehension (for empirical evidence, see Cromer, 1970; Levin, 1973; and Rowher & Harris, 1975). Thus, the chances of assessing effects on comprehension per se can be increased by using only subjects who are skilled decoders. Then, inability to perform well on

a prose-learning or comprehension test cannot be attributed to the subject's inability to read.[1]

Another means of getting around decoding inadequacy is to present prose passages orally; that is, to have subjects listen to them rather than read them. There exists substantial documentation that among skilled decoders the comprehension demands and performance associated with reading are similar to those associated with listening (see, for example, Perfetti, 1977; Perfetti & Lesgold, in press; and Smiley, Oakley, Worthen, Campione, & Brown, 1977). Therefore, conclusions made about listening comprehension have direct implications for reading comprehension. It is important to note that this listening groundrule may be an especially salient one vis-à-vis Samuels' (1970) discussion of pictures and prose comprehension. Generalizing from a number of decoding studies, Samuels speculates that pictures serve to divert subjects' attention away from the text, thereby preventing them from processing all of the relevant textual information. For present purposes it will be assumed that the hypothesized distraction is not a factor when text is presented orally since looking and listening in this context are complementary, rather than competing, information-processing activities (see, for example, Levin & Divine-Hawkins, 1974).

Besides eliminating word-decoding problems and counteracting potential picture-word attention conflicts, oral presentations of text have at least one other important advantage: They lend themselves to better control of the rate of presentation which in turn relates to the number of opportunities afforded for information processing. With printed materials, if a relatively short amount of study time is provided, one cannot be sure that all subjects have completed reading the passage; and if a relatively long period of study time is provided, some may reread part or all of the passage (for one solution, see Levin & Divine-Hawkins, 1974). In contrast, with an oral presentation, time is easily controlled. Utterance speed can be decided upon, as can the amount of empty time between sentences. In addition, the number of exposures to the passage is not a problem with this mode of presentation, since once a word has been spoken it is physically gone.

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[1] Since most prose-learning tests are administered following presentation of a passage, they are technically measuring memory rather than comprehension per se. There are various methods for assessing comprehension without placing excessive demands on the subjects' memory for passage information, such as by having them execute actions in response to simple commands (e.g., Farnham-Diggory, 1967), by having them answer questions with a printed text in full view (e.g., Rohwer & Matz, 1975) or by recording latencies associated with determining the truth or falsity of a series of propositions (e.g., Clark & Chase, 1972). However, comprehension without recall is the exception rather than the rule in the prose-learning literature--and in the classroom.

Children

When reviewing the research results of a particular area of investigation, one might be tempted to group together studies based on subjects with quite different demographic characteristics. In the prose-learning area, the subject's age is a variable that is likely to moderate the effectiveness of various adjunct aids (see for example, Rohwer, 1973). Therefore, in our discussion we are including only research on elementary school-aged children. Whether our conclusions will generalize to older subject populations is not yet determinable, since the many studies that have been conducted do not overlap sufficiently in methodology to satisfy our other groundrules or any other specific criteria.

Fictional Narratives

We will consider only research that uses unfamiliar stories as the prose passages, and not research in which the passages consist of (possibly familiar) units from, say, a science or social studies curriculum. This gives us more control over the related prior knowledge that subjects may bring to the task. In studies involving curriculum-related passages, it is difficult for the researcher to separate out what is learned from what is already known.[2]

A related problem is whether subjects are capable of demonstrating "learning" even without previous exposure to the specific passages. Tuinman (1973-74), for example, discovered that for several standardized reading tests currently in use, subjects could answer many questions without having read the relevant passage. (There is plenty of evidence for the major role played by prior knowledge, e.g., Chiesi, Spilich, & Voss, in press; Cofer, 1973; and Rumelhart & Ortony, 1977.) In certain of the studies discussed here, attempts to deal with the prior knowledge problem have been made by including an independent group of question-only "norming" subjects during construction of the passages (see Bender & Levin, in press; and Guttmann, Levin, & Pressley, 1977). Hopefully in the future we will see more general sensitivity to the knowledge environments within which studies of prose learning are conducted.

Text-Overlapping Pictures

Pictures accompanying a prose passage may be of many types and serve many different functions. For example, at the commercial textbook level the aesthetic character of pictures appears to be a primary

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[2] Analysis of covariance represents a statistical solution to this problem, though it is one that is not completely satisfactory on substantive grounds in many situations.

consideration. At the research level, pictures have served as advance organizers (Ausubel, 1968). In some studies, pictures illustrating only a small segment of the text, or even something irrelevant to the text, have been employed. Even visual aids such as graphs, Venn diagrams, flow charts and the like have been lumped into the "picture" category because of their nonverbal nature.

In contrast to this variety of pictures, those we consider here are completely overlapping adjuncts to the text; that is, they convey the same information as that conveyed by the text itself.[3] While it is not possible to say that the pictures contain exactly the same information (since most pictures include incidental spatial relationships and details not likely conveyed by the text) they are redundant in that they are sufficient for conveying the basic propositional content of the text (even though some children may have difficulty interpreting the pictures fully in the absence of the text--cf. Levin, 1973; Rohwer & Harris, 1975). Fictional narrative passages are especially convenient for this purpose and are preferred over the previously discussed curriculum-related texts where pictures are not self-sufficient but frequently serve to decorate the text or highlight certain aspects of it (see, for example, Gustafson, 1974). This groundrule implies that the passages must be illustrable and, therefore, concrete. Although there have been a few attempts to apply pictures, in a "concretizing" role, to relatively abstract passages (see Davidson, 1976), possibilities in this area need to be more fully explored.

Factual Recall

The purpose of this final groundrule is to distinguish between assessments of a passage's factual information on the one hand and assessments of its theme, mood, logically-derived inferences, and the like on the other. Investigators have been concerned with a variety of performance measures, and it is possible that pictures affect each of these quite differently. At the very least, different types of pictures serve different "comprehension" purposes (see Groundrule 4). We will restrict our attention here to factual information recall tapped by short-answer (generally "Wh") questions.

Having decided that recall will be the criterion, a researcher is still faced with two assessment decisions that must be resolved. First is the question of the means by which recall will be measured; and

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[3] Whether such pictures are actual photographs, or black-and-white or colored line drawings, has been of interest to some investigators. The research we consider typically involves line drawings (in most cases colored but in some not), and this "style" issue will not be addressed here.

second, in situations where between-group comparisons are of interest, is the question of appropriate comparison groups.

Measuring Recall. As mentioned above, we will be considering only studies in which cued recall was one of the measures (although some studies also measured free recall, e.g., Lesgold, Levin, Shimron, & Guttmann, 1975). Our rationale for this decision is that free-recall protocols may not always accurately reveal the extent of the knowledge a child has acquired from a text. In three recent sets of studies, free-recall performance was so low in all experimental conditions, relative to cued-recall performance, that "floor" effects were produced (Lesgold et al., 1975; Lesgold, DeGood, & Levin, in press; Levin, Bender, & Lesgold, 1976).

We have considered several hypotheses in an attempt to explain the free-recall performance gap. First, young children may not freely report facts about which they have any uncertainty, and questioning may resolve that uncertainty or elicit the response. Second, they may lack certain general retrieval skills needed for the free-recall task (cf. Brown, 1976). Third, they may not make successful decisions about what they need to say to get a high score and what is "obvious" from other facts they have stated, involving subjective decisions about which information is and which is not relevant (for a more precise description, see Stein & Glenn, 1977). Finally, researchers do not always use materials with a well-developed macrostructure. That is, the materials often consist of unordered sets of descriptive details rather than a logical sequence. Although systematic data resolving the free-recall problem are not yet available, a method for seeking recall of facts without as much cueing as questions usually provide can be found in Guttmann et al. (1977, Exp. 3). We will return to the story-assessment problem in a later section.

Baseline for Assessing Picture Effects. The first thing that comes to mind when attempting to determine whether pictures facilitate children's prose learning is the legitimate question, "In comparison to what?" Levin et al. (1976) have addressed this issue in a recent article. In almost every prose-learning study in which picture effects have been assessed, a group that receives the text plus some picture variation is compared with a group that received the text only. Thus, these two groups differ not only with respect to the kind of materials they receive, but also with respect to the amount.

In order not to confound quality and quantity aspects of such manipulations, we would certainly recommend that researchers employ double-exposure (repetition) control groups when assessing the effect of adjunct materials such as pictures (see Levin et al., 1976). On the other hand, studies not adopting repetition controls might be justifiable on "ecological validity" grounds (Bracht & Glass, 1968), since in classrooms and in other real-world situations a single presentation is used most of the time. Unless otherwise stated, the comparison groups referred to in the remainder of this paper are of the single-presentation variety.

With these two methodological remarks in mind, then--and recalling our groundrules--let us now consider the evidence.

THE EVIDENCE

As is true of most educational-psychological research endeavors, questions relating to each side of the hyphen can be asked. That is, one can focus on the educational (or practical) side, in which case one assembles evidence to answer the question, "Are pictures effective?" One can also focus on the psychological (or theoretical) side, and deal with the question, "Why are pictures effective?" In this paper we will respond primarily (though not exclusively) to the first of these two questions, with the second to be addressed more fully at a later time.[4]

In short, the research that we have encountered which seems to adhere to our groundrules provides overwhelming support for a picture-positive position (Bender & Levin, in press; Guttmann et al., 1977; Lesgold et al., in press; Lesgold et al., 1975; Levin et al., 1976; Rohwer & Harris, 1975; Rohwer & Matz, 1975; Ruch & Levin, 1977; Levin, Bender, & Pressley, 1978; Peng & Levin, 1978; Shimron, 1974). In each of these studies, children listened to a concrete narrative passage. Some of the children were also shown pictures which captured the story's contents. Comparisons of picture and control subjects' performance were based on recall of a series of short-answer factual questions following presentation of the passage. As indicated above, evidence of picture facilitation is consistent across these studies.

For example, in the Guttmann et al. (1977, Exp. 1) study, across three grade levels (K, 2nd, and 3rd), children correctly responded to about 80 percent of the short-answer questions when pictures accompanied oral narratives and only to about 57 percent in the no-picture control condition. Using different narrative passages of varying lengths and complexities, Lesgold et al. (in press) reported that their first graders correctly recalled about 68 percent with pictures and only about 47 percent without them. With a retarded population, Bender and Levin (in press) found that picture subjects correctly responded to about 64 percent of the questions, in comparison to the control figure of about 34 percent--an increase among picture subjects of 89 percent! These data clearly suggest that picture effects are not only pervasive, but also of impressive magnitude.

If one or more of our groundrules is relaxed in a study, the effects of pictures may no longer be positive. Our own problems with free-recall measures, for example, have shown us that the efficacy of a picture adjunct is not universal. At the same time, it should be apparent from the research we review here that consistent positive

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[4] Glass (1972) has similarly distinguished between "evaluative" (Question 1 - type) and "elucidatory" (Question 2 - type) inquiry, expressing his bias toward the former in the context of educational research.

picture effects have been found with procedures that generalize across a number of subject and situational variables. We will now identify some of these generalization variables.

Across Baselines

Although the "double exposure" explanation of picture effects first came to the attention of Lesgold et al. (1975), they were quick to rule it out based on a review of the verbal-learning literature--in particular, that documenting the relative impotency of single "massed" repetitions on performance. This dismissal turned out to be premature, however, for when Levin et al. (1976) studied the matter empirically, they found that children (first graders) who were allowed to listen to each sentence twice in succession did perform better than subjects who heard each sentence only once. This result has since been replicated with third graders (Ruch & Levin, 1977; Bender, 1977). Thus, it may be concluded that in the context of children's oral prose learning, simple repetition indeed appears to improve performance (see also Nelson's, 1977, recent review in support of the phenomenon in word-learning studies).

Is the repetition explanation sufficient to account for the picture effects under consideration here? That is, is a picture nothing more than a repetition of the text it accompanies? This seems not to be the case, since Levin et al. (1976, Exp. 3) found that although repetition did facilitate performance, pictures facilitated it even more. Exactly what the unique contributions of pictures are has been the subject of recent research (Bender & Levin, in press; Guttmann et al., 1977, Exp. 3; Lesgold, Curtis, Roth, & Riley, 1977; Levin et al., 1978; and Ruch & Levin, 1977), some of which will be discussed shortly.

The implications of these findings are clear. Pictures do improve children's oral prose learning, but the amount of this improvement depends on the particular "baseline" selected. Relative to a listen-once control, a picture plus listening condition generally results in at least 40 percent improvement. When the more rigorous listen-twice control is adopted, the difference appears to be approximately halved (Levin et al., 1976).

Across Methods of Presentation

In the studies cited earlier, several different methods of presenting pictures were adopted. Since positive picture effects were obtained in all cases, however, this particular variable does not appear to be crucial. Pictures may be presented simultaneously with the text (e.g., Guttmann et al., 1977), following each sentence (e.g., Levin et al., 1976, Exp. 2) or following each passage (e.g., Lesgold et al., 1975). Moreover, a picture may contain information related only to a specific sentence (e.g., Guttmann et al., 1977) or to all previous sentences (e.g., Rohwer & Matz, 1975).

Pictures have been displayed as line drawings in booklets (e.g., Guttmann et al., 1977), and as slides on a screen (e.g., Rohwer & Matz, 1975). They have even consisted of laminated plastic cutouts placed on a background board (e.g., Lesgold et al., 1975). In the latter case, whether the experimenter assembles the appropriate cutouts or the subject assembles them does not appear to make a difference. (However, Lesgold et al., 1975, Exp. 3, were able to create an interference situation in the subject-assembly version by requiring subjects to select cutouts for their illustrations from a larger pool.) Neither is it necessary for the cutouts to remain in view throughout the duration of the passage (e.g., Levin et al., 1976, Exp. 2) nor for them to be physically integrated with the background (e.g., Shimron, 1974).

Across Learner Characteristics

Four obvious learner characteristics can be identified in the picture-prose studies that we are considering: the child's sex, age, social class, and intellectual ability. Interestingly, positive picture effects have been obtained with students representing different levels within each of these characteristics. That is to say, both males and females benefit from pictures. So do children at all ages between 6 and 12 (i.e., throughout the elementary school grades). Picture facilitation has been obtained in both rural and urban communities; and with children drawn from both middle-class white populations and from lower-class black populations. Finally, conclusions based on children with "average" or "above average" intelligence have recently been extended to include educable mental retardates (Bender & Levin, in press). As an interesting aside, and with reference to our earlier discussion of simple repetition effects, Bender and Levin found that repetition per se did not improve the performance of either younger (9 to 11.5 years of age) or older (12.5 to 15) retardates whereas pictures did for both age groups.

Across Passage Characteristics

Even given our fictional narrative groundrule, there are other ways in which passages may vary. Two of these which have been experimentally investigated to date consist of the length and the complexity of a passage. Lesgold et al. (in press) found that pictures improved children's performance on both relatively short passages (50 words in length) and longer ones (100 words). Similarly, pictures were helpful for both more and less complex passages, as defined by the number of different locations (scene settings) referred to in the narrative. Positive picture effects emerged across the various length and complexity manipulations and, in addition, the amount of facilitation due to pictures did not appear to vary systematically with such manipulations.

It is worth noting that since the amount of facilitation due to pictures was unrelated to the factors manipulated by Lesgold et al. (in press), one might tentatively conclude that pictures do not extract a "cost"--in processing capacity--that would render them less useful in

more complex prose-learning situations. Concerning costs from a different perspective, Levin et al. (1978) have recently found that pictures do not appear to benefit certain types of passage information at the expense of others. In that study, children were asked to recall both central, thematic information and incidental details contained in sentences. Picture subjects recalled more of each in comparison to no-picture controls.

Across "Levels" of Recall

As was noted earlier, the method by which prose-learning performance is assessed may well make a difference. In particular, cued-recall procedures have been found to elicit more respectable levels of performance in comparison to free recall (see Groundrule 5). Most cued-recall performance to date, however, derives from what may be referred to as "verbatim" questions (cf. Anderson, 1972). With such questions, the verbatim information originally presented in the passage is simply rearranged to form a question (e.g., "John returned to his house" becomes "Who returned to his house?"). Unfortunately, the simplicity-of-construction advantage associated with verbatim questions may have an overcompensating performance-interpretation disadvantage.

According to certain contemporary cognitive-psychological theorists, comprehension increases as a function of the "depth" to which information is processed (e.g., Craik & Lockhart, 1972; Paivio, 1971), and verbatim questions are presumed to reflect relatively shallow "levels" of information processing (see, for example, Anderson, 1972; and Andre & Sola, 1976). That is, one is able to answer such questions correctly even in the absence of deep processing of the original information, on the basis of the rote, surface characteristics of the passage (such as phonological cues).[5]

Because of this, Anderson (1972) has recommended that test constructors regularly employ questions in which the original information has been paraphrased using different lexical terms. (For the above example, a paraphrase question might be "Who came home?") In order to answer such questions correctly, subjects presumably will have had to process the passage information at a deeper-than-rote level, since surface (e.g., phonological) cues are no longer available in the questions themselves.

Recently, attempts have been made to assess the level of processing associated with pictures (Bender & Levin, in press; Peng & Levin, 1978;

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[5]Note that this problem is not restricted to short-answer question performance, but has implications for free-recall measures as well. Given that floor effects have been eliminated, apparently high propositional recall scores may still be composed of strings of rotely learned information. This is especially important to consider when a short passage is presented, followed by an immediate test.

and Ruch & Levin, 1977). These authors reasoned that if pictures serve simply to enhance students' rote learning of passage information, their effect should be restricted to verbatim questions. On the other hand, if pictures induce deeper processing of the prose material, positive effects should show up with paraphrase questions as well. Using a mixed list of verbatim and paraphrase questions, they found that picture effects were quite comparable on the two question variations.

An interesting contrast in the Ruch and Levin (1977) experiment relates to the question of an appropriate baseline for assessing picture effects, which we mentioned above. These authors found that whereas positive picture effects emerged relative to single- and double-exposure control groups for both verbatim and paraphrase questions, the superior performance of the listen-twice subjects to the listen-once subjects was restricted to verbatim questions. Such results are important in that they point to possible qualitative information-processing differences associated with pictures on the one hand and simple verbal repetition on the other. Repetition appears to provide more of what was already processed at a rote level; pictures, however, may well provide a context within which passage information can be more deeply organized. Ruch and Levin discuss additional implications of these findings.[6]

Even though some of the studies included here have varied the level of processing required to answer questions, the research in this area typically has not included qualitative analyses of recall in terms of discourse-structure components (cf. Mandler & Johnson, 1977; Stein & Glenn, 1977), nor even the more general analyses that could be derived for determining the importance of specific facts to an overall discourse (van Dijk, in press). Nonetheless, insofar as we are concerned with factual recall of narratives (along with the other groundrules), we believe that our findings can be interpreted even within the discourse-structure approach. That is to say, it is not clear that structure of the discourse will matter, which implies that there are probably few complicated interactions involving picture-no picture comparisons and the type of facts recalled. First, we know that even young children can understand and, given adequate exposure and eliciting conditions, reproduce the essential macrostructure of narrative passages (Mandler & DeForest, 1977). Moreover, when they are pressed by the length of the story or other problems, they recall less detail and lose structure components that are not essential to the most basic message the story

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[6] The levels-of-processing analysis offered here is not meant to be exclusive from other contemporary theoretical accounts of memory enhancement. Notions derived from dual coding (e.g., Paivio, 1971), a sensory-semantic model (e.g., Nelson, Reed, & McEvoy, 1977), and schema theory (e.g., Rumelhart & Ortony, 1977) overlap with some of those mentioned above, and may ultimately prove more valuable in accounting for the pictures-in-prose phenomenon.

contains (e.g., Mandler & Johnson, 1977). We think, therefore, that some qualitative analyses of the kinds of facts for which pictures improve performance would be helpful (especially for increasing our theoretical understanding of a picture's contribution), but doubt that the results of such studies will force change in our arguments about picture efficacy.

Across Time

In the research we have been reviewing, a common procedure is to administer a short-answer test immediately following the presentation of the passage. However, a number of variations of this procedure have also produced picture facilitation. For example, the effect has been obtained when two or more passages are presented in succession, and whether or not the subjects' free recall of the passage has first been solicited. It also appears to make little difference whether the questions are asked immediately following each passage or following all of them (e.g., Guttmann et al., 1977; Lesgold et al., 1975; Levin et al., 1976).

Of particular interest to those concerned with the practical side of picture effects is the question of their persistence over time. Although the long-term limits have yet to be fully explored, Peng and Levin (1978) have provided an encouraging first step. Based on both independent- and same-subject comparisons, these authors found that the amount of picture facilitation for children tested three days following the presentation of the passages was as great as that for children tested immediately following their presentation. Moreover, comparable pictorial facilitation effects were observed for verbatim and paraphrase questions.

SUMMARY AND CONCLUSIONS

Based on the evidence presented, one cannot help but conclude that picture facilitation of children's prose learning is ubiquitous. That is to say, as long as one adheres to the five groundrules specified at the outset, positive effects of pictures invariably appear--even when comparisons are made with listen-twice control subjects. As inferred on the basis of questions with presumed different comprehension demands associated with them, the greater facilitation attributable to pictures over simple repetition seems to result from their inducing deeper levels of processing in the subject. Convergent analyses bearing on this conclusion remain to be conducted, however.

Picture effects were also seen to generalize across a number of situational variables, including methods of presentation and testing. Children of varying characteristics all benefited from pictures, suggesting that pictures may constitute such potent prose-learning aids that individual differences in performance can be considerably reduced. With respect to age differences, for example, it is not uncommon to find that young children who are given a picture treatment perform, on the

average, as well or better than children several years older who are not given pictures (e.g., Guttmann et al., 1977, Exp. 1). The same can be said of retardate-normal comparisons (Bender, 1977). Preliminary work also suggests that the learning gains due to pictures persist over time--at least up to a period of three days. Frankly we would be quite surprised if this period did not turn out to be a great deal longer.

Finally--and with explicit regard to the present article--although we have concentrated here on oral prose learning (see Groundrule 1), we do not mean to imply that pictures will not similarly benefit those who are reading for comprehension. Indeed, a literature review currently being prepared by Schallert (1977) affords clear evidence that picture-positive effects are quite pervasive in the reading domain as well.

REFERENCES

Anderson, R. C. How to construct achievement tests to assess comprehension. Review of Educational Research, 1972, 42, 145-170.

Andre, T., & Sola, J. Imagery, verbatim and paraphrased questions, and retention of meaningful sentences. Journal of Educational Psychology, 1976, 68, 661-669.

Ausubel, D. P. Educational psychology: A cognitive view. New York: Holt & Co., 1968.

Bender, B. G. The effects of imposed and induced visual elaboration on EMR children's learning from oral prose. Unpublished doctoral dissertation, University of Wisconsin, Madison, 1977.

Bender, B. G., & Levin, J. R. Pictures, imagery, and retarded children's prose learning. Journal of Educational Psychology, in press.

Bracht, G. H., & Glass, G. V. The external validity of experiments. American Educational Research Journal, 1968, 5, 437-474.

Brown, A. L. The construction of temporal succession by preoperational children. In A. D. Pick (Ed.), Minnesota symposia on child psychology (Vol. 10). Minneapolis: University of Minnesota Press, 1976.

Chiesi, H. L., Spilich, G., & Voss, J. F. Processes of acquisition in individuals with high and low baseball knowledge: The first inning. Technical Report, Learning Research and Development Center, University of Pittsburgh, in press.

Clark, H. H., & Chase, W. G. On the process of comparing sentences against pictures. Cognitive Psychology, 1972, 3, 472-517.

Cofer, C. N. Constructive processes in memory. American Scientist, 1973, 61, 537-543.

Concannon, S. J. Illustrations in books for children: Review of research. Reading Teacher, 1975, 29, 254-256.

Craik, F. I. M., & Lockhart, R. S. Levels of processing: A framework for memory research. Journal of Verbal Learning and Verbal Behavior, 1972, 11, 671-684.

Cromer, W. The difference model: A new explanation for some reading difficulties. Journal of Educational Psychology, 1970, 61, 471-483.

Davidson, R. E. The role of metaphor and analogy in learning. In J. R. Levin & V. L. Allen (Eds.), Cognitive learning in children: Theories and strategies. New York: Academic Press, 1976.

DeRose, T. M. The effects of verbally and pictorially induced and imposed strategies on children's reading comprehension. Unpublished doctoral dissertation, University of Wisconsin, Madison, 1976.

Farnham-Diggory, S. Symbol and synthesis in experimental reading. Child Development, 1967, 38, 223-231.

Gibbons, A. S., & Boutwell, R. C. The effects of instructions and provided illustrations on a memory task using prose materials. Paper presented at the annual meeting of the California Educational Research Association, San Jose, November 1972.

Glass, G. V. The wisdom of scientific inquiry on education. Journal of Research in Science Teaching, 1972, 9, 3-18.

Goldberg, F. Effects of imagery on learning incidental material in the classroom. Journal of Educational Psychology, 1974, 66, 233-237.

Golinkoff, R. M. A comparison of reading comprehension processes in good and poor comprehenders. Reading Research Quarterly, 1975-76, 11, 623-659.

Gustaffson, J.-E. Verbal versus figural in aptitude-treatment interactions: Review of the literature and an empirical study. Report No. 36, Institute of Education, University of Göteborg, Sweden, 1974.

Guttmann, J., Levin, J. R., & Pressley, M. Pictures, partial pictures, and young children's oral prose learning. Journal of Educational Psychology, 1977, 69, 473-480.

Hempstead, J. O. Media and the learner: The influence of media-message components on students' recall and attitudes toward the learning experience. Unpublished doctoral dissertation, University of Wisconsin, Madison, 1973.

Jahoda, G., Cheyne, W. M., Deregowski, J. B., Sinha, D., & Collingbourne, R. Utilization of pictorial information in classroom learning: A cross cultural study. AV Communication Review, 1976, 24, 295-315.

Lesgold, A. M., Curtis, M. E., Roth, S. F., & Riley, M. S. Foregrounding and discourse comprehension. Paper presented at the annual meeting of the Psychonomic Society, Washington, D. C., November 1977.

Lesgold, A. M., DeGood, H., & Levin, J. R. Pictures and young children's prose learning: A supplementary report. Journal of Reading Behavior, in press.

Lesgold, A. M., Levin, J. R., Shimron, J., & Guttmann, J. Pictures and young children's learning from oral prose. Journal of Educational Psychology, 1975, 67, 636-642.

Levin, J. R. Inducing comprehension in poor readers: A test of a recent model. Journal of Educational Psychology, 1973, 65, 19-24.

Levin, J. R. What have we learned about maximizing what children learn? In J. R. Levin & V. L. Allen (Eds.), Cognitive learning in children: Theories and strategies. New York: Academic Press, 1976.

Levin, J. R. Imagery processes in children's prose learning. Paper presented at the annual meeting of the American Educational Research Association, New York, April 1977.

Levin, J. R., Bender, B. G., & Lesgold, A. M. Pictures, repetition, and young children's oral prose learning. AV Communication Review, 1976, 24, 367-380.

Levin, J. R., Bender, B. G., & Pressley, M. Pictures, imagery, and children's recall of central versus peripheral story information. Manuscript in preparation, 1978.

Levin, J. R., & Divine-Hawkins, P. Visual imagery as a prose-learning process. Journal of Reading Behavior, 1974, 6, 23-30.

Mandler, J. M., & DeForest, M. The code in the node: Developmental differences in the use of a story scheme. Paper presented at the biennial meeting of the Society for Research in Child Development, New Orleans, March 1977.

Mandler, J. M., & Johnson, N. S. Remembrance of things parsed: Story structure and recall. Cognitive Psychology, 1977, 9, 111-151.

Nelson, D. L., Reed, V. S., & McEvoy, C. L. Learning to order pictures and words: A model of sensory and semantic encoding. Journal of Experimental Psychology: Human Learning and Memory, 1977, 3, 485-497.

Nelson, T. O. Repetition and depth of processing. Journal of Verbal Learning and Verbal Behavior, 1977, 16, 151-171.

Paivio, A. Imagery and verbal processes. New York: Holt & Co., 1971.

Peeck, J. Retention of pictorial and verbal content of a text with illustrations. Journal of Educational Psychology, 1974, 66, 880-888.

Peng, C.-Y., & Levin, J. R. Longer term effects of pictures on children's story recall. Paper presented at the annual meeting of the American Educational Research Association, Toronto, March 1978.

Perfetti, C. A. Language comprehension and fast decoding: Some psycholinguistic prerequisites for skilled reading comprehension. In J. Guthrie (Ed.), Cognition, curriculum, and comprehension. Newark, Del.: International Reading Association, 1977.

Perfetti, C. A., & Lesgold, A. M. Discourse comprehension and sources of individual differences. In M. Just & P. Carpenter (Eds.), Cognitive processes in comprehension. Hillsdale, N. J.: Erlbaum, in press.

Rasco, R. W., Tennyson, R. D., & Boutwell, R. C. Imagery instructions and drawings in learning prose. Journal of Educational Psychology, 1975, 67, [illegible]192.

Rigney, J. W., & Lutz, K. A. Effect of graphic analogies of concepts in chemistry on learning and attitude. Journal of Educational Psychology, 1976, 68, 305-311.

Rohwer, W. D., Jr. Elaboration and learning in childhood and adolescence. In H. W. Reese (Ed.), Advances in child development and behavior, (Vol. 8). New York: Academic Press, 1973.

Rohwer, W. D., Jr., & Harris, W. J. Media effects on prose learning in two populations of children. Journal of Educational Psychology, 1975, 67, 651-657.

Rohwer, W. D., Jr., & Matz, R. Improving aural comprehension in white and black children: Pictures versus print. Journal of Experimental Child Psychology, 1975, 19, 23-36.

Ruch, M. D., & Levin, J. R. Pictorial organization versus verbal repetition of children's prose: Evidence for processing differences. AV Communication Review, 1977, 25, 269-280.

Rumelhart, D. E., & Ortony, A. The representation of knowledge in memory. In R. C. Anderson, R. J. Spiro, & W. E. Montague (Eds.), Schooling and the acquisition of knowledge. Hillsdale, N.J.: Erlbaum, 1977.

Schallert, D. L. Personal communication, December 1977.

Samuels, S. J. Effects of pictures on learning to read, comprehension and attitudes. Review of Educational Research, 1970, 40, 397-407.

Shimron, J. Imagery and the comprehension of prose by elementary school children. Unpublished doctoral dissertation, University of Pittsburgh, 1974.

Smiley, S. S., Oakley, D. D., Worthen, D., Campione, J. C., & Brown, A. L. Recall of thematically relevant material by adolescent good and poor readers as a function of written versus oral presentation. Journal of Educational Psychology, 1977, 69, 381-387.

Snowman, J., & Cunningham, D. J. A comparison of pictorial and written adjunct aids in learning from text. Journal of Educational Psychology, 1975, 67, 307-311.

Stein, N. L., & Glenn, C. G. An analysis of story comprehension in elementary school children. In R. Freedle (Ed.), Discourse processing: Multidisciplinary perspectives. Maplewood, N.J.: Ablex, Inc., 1977.

Tuinman, J. L. Determining the passage dependency of comprehension questions in 5 major tests. Reading Research Quarterly, 1973-74, 9, 206-223.

van Dijk, T. A. Macrostructure and cognition. In M. Just & P. Carpenter (Eds.), Cognitive processes in comprehension. Hillsdale, N.J.: Erlbaum, in press.